

### ABSTRACT OF THE INVENTION

Disclosed are methods for modeling multi-dimensional domains by merging multiple input data sets into a model, applying multiple dynamic theories to evolve the model, and using information theory to resolve gaps in, and discrepancies among, the data sets and the theories. One example is a three-dimensional geologic basin simulator that integrates seismic inversion techniques with other data to predict fracture location and characteristics. The geologic simulator delineates the effects of regional tectonics, petroleum-derived overpressure, and salt tectonics and constructs maps of high-grading zones of fracture producibility. A second example is a living cell simulator that uses chemical kinetic rate laws of transcription and translation polymerization to compute mRNA and protein populations as they occur autonomously, in response to changes in the surroundings, or from injected viruses or chemical factors. Features such as the eukaryotic nucleus are treated with a novel mesoscopic reaction-transport theory. Metabolic reactions take place in appropriate compartments.